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RECENT USSR WORK IN THE FIELD OF ANTIBIOTICS

Prof G. F. Gauze

/Comment: The following information has been taken from parts of a public lecture published by the All-Union Society for the Dissemination of Political and Scientific Knowledge. For an earlier report on the same topic, "New Soviet Data on Antibiotics," 8 October 1951./

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A new branch of medical industry has been created in the USSR, the specialized branch of industry which manufactures antibiotics The antibiotics industry, which applies modern technological methods, completely satisfies the needs of the USSR public health services for penicillin and streptomycin of high quality. The production of gramicidin S has also grown considerably. Soviet scientists have developed a synthesis of the antibiotic synthomycin, and this antibiotic is being produced in large quantities. The original USSR antibiotic albomycin is also supplied by industry.

As early as 1922, Prof N. F. Gamaleya obtained an antibiotic preparation, which he called pyoclastin, from cultures of Bacillus pyocyaneus. During recent years, a many-sided investigation of antibiotics from B. pyocyaneus was carried out by Prof V S Derkach and his collaborators at the Khar'kov Institute imeni I I. Mechnikov. One of the most interesting preparations belonging to this group of compounds was named sanazin.

A systematic investigation of the antagonism between microorganisms was started by Soviet scientists in 1935-1938 at the Institute of Microbiology, Academy of Sciences USSR. Work done by Yu. A. Borodulina and M. I. Nahimovskaya established that soils often contain fungi of the Actynomycetaceae family. Some of them form antibiotics which kill soil bacteria. Prof N. A. Krasil'nikov, in a monograph dealing with Actinomycete fungi, classified these microorganisms on the basis of their ability to form antibiotics. N. A. Krasil'nikov and A. I. Korenyako discovered a new, hitherto unknown antibiotic which is developed by the violet actinomycete /Actinomyces lavendulae?/, and named it mycetin.

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In 1922-1924, I. G. Shiller, the Odessa microbiologist, demonstrated that some microorganisms acquire antibiotic properties in the presence of other microorganisms. He called this interesting phenomenon "enforced antagonism." Lately, M. O. Streshinskiy has continued work along these lines. He found that a definite culture of the hay bacillus forms an antifungus substance only when a Penicillium fungus is present. Contact with the bacilli in turn reinforces the antagonistic properties of the fungus.

Soviet gramicidin (gramicidin S) was originally isolated by G. F. Gauze and M. G. Brazhnikov in 1942 at the Institute of Malaria and Medical Parasitology, Academy of Medical Sciences USSR, from a strain of Bacillus brevis var. G.-B. found in the soil near Moscow. The antibiotic crystallizes from the alcoholic extract of Bacilli brevis var. G.-B. Crystalline gramicidin S is a white powder which melts at 268-270°C. It is not digested by proteolytic enzymes and hydrolyzes only with great difficulty on being heated with concentrated acids.

Industry supplies gramicidin S in the form of a 4% alcoholic solution packed in ampules or bottles. This antibiotic is applied as an aqueous solution containing 400 gammas of the substance per one cubic centimeter of solution. It can also be used in the form of weak alcoholic solutions, of ointments, and as a powder prepared by moistening glucose with an alcoholic solution of the antibiotic and then drying the glucose.

One of the characteristics of gramicidin S is that it has a selective action: it kills bacteria, but does not damage the cells of the human body either on local or internal application. It has been successfully used in military field surgery, for the treatment of suppurating wounds, the treatment of joints infected with pus, of suppurative inflammations of the chest and abdominal cavities, of suppurative diseases of the bones, of amebic colites and bacillary dysentery (by introducing it with the aid of a catheter into the large intestine in combination with sulfa drugs), and of balantidiasis. Gramicidin S has been found particularly useful in that it insures successful healing of wounds after skin grafts have been made in cases of extensive burns or other injuries to the epithelium.

Synthetic racemic chloromycetin prepared according to a method developed by Soviet chemists who worked under the direction of Prof F. S. Khanenya, Laureate of the Stalin Prize, has received the name of synthomycin. Synthetic chloromycetin, which is optically active, because it consists wholly of the levorotatory enanthiomorph, is known under the name of levomycetin. The synthesis of levomycetin has been carried out by workers of the Institute of Biological and Medicinal Chemistry, Academy of Medical Sciences USSR

Albomycin is a USSR antibiotic which was originally discovered at the Laboratory of Antibiotics, Academy of Medical Sciences USSR. It was obtained by isolating it from the culture medium of a definite species of microorganism and then purifying it chemically. Albomycin suppresses the growth of a number of gram-positive as well as gram-negative bacteria. It is absolutely nontoxic; this substance is the only known antibiotic besides penicillin which exhibits no toxic properties. Albomycin is effective against penicillin-resistant staphylococci and may be used to treat septic diseases caused by them It reinforces the action of penicillin, streptomycin, and certain sulfa drugs and is in turn reinforced by them. In this respect it differs from chloromycetin or aureomycetin: these two antibiotics weaken the action of penicillin when they are used together with it against the same pathogenic microorganism.

Albomycin is a light-yellow powder which is easily soluble in water or a physiological salt solution One milligram of albomycin contains 300,000 active units. One active unit of albomycin is defined as the quantity of antibiotic which suppresses the growth of staphylococci of a standard strain that are contained

in 1 milliliter of nutrient agar. Albomycin is packed in bottles containing 5 million units each. To prepare a solution of the antibiotic, which is administered subcutaneously, the contents of the bottle are dissolved in 20 milliliters of twice-distilled water.

Recently, Prof Z. V. Yermol'yeva and her collaborators at the All-Union Scientific Research Institute of Penicillin and Other Antibiotics developed the antibiotic preparation ekmolin, which is obtained from tissues of fish. According to published data, ekmolin in combination with novocain and penicillin is successfully used to prolong the period during which penicillin circulates in the organism.

N. M. Pidoplichko, V. I. Bilay, M. F. Gul, and E. T. Soreni, who are Scientific Associates of the Institute of Microbiology, Academy of Sciences Ukranian SSR, Kiev, developed the antibiotic microcide (mikrotsid), which is recommended for external use as a local antiseptic. Published data indicate that microcide has the property of purifying infected wounds from pyogenous microflora. At present this drug is successfully used in medical practice.

Interesting results have been obtained with antibiotics from higher plants, the so-called phytoncides which were discovered in 1928 by B. P. Tokin. Experimental work which had been conducted in this field demonstrated that many higher plants emit volatile substances that kill protozoa and bacteria at a distance. Thus, volatile substances evolved by a twig and leaves of the bird-cherry tree, or by cut leaves of the birch were shown to kill infusoria. Other investigations proved that the vapors and extracts of garlic exert a strong bactericidal effect. One of the drawbacks of phytoncides is their chemical instability.

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